PROSTRATENESS IN ACACIA FARNESIANA FROM THE WESTERN COAST OF MEXICO UNDER UNIFORM ENVIRONMENTAL CONDITIONS

Calvin McMillan
Department of Botany and Plant Ecology Research Laboratory,
University of Texas, Austin 78712

Acacia farnesiana (L.) Willd. populations in Sinaloa, Mexico, have diverse stem orientation. Those on sandy beaches along Mazatlan Bay are extremely prostrate. Though not continuous in distribution, plants in clay soils 4.8 km. east of the dunes have upright stems typical of populations in Mexico and Texas. To determine if stem orientation was a local modification in a beach habitat by otherwise upright plants, collections from various beach and inland sites were compared under uniform conditions in central Texas.

Beaches were visited in Nayarit (San Blas), Sonora (Guaymas), and Colima (Manzanillo), but *A. farnesiana* was not observed in sandy habitats similar to those of populations along the Sinaloa coast. Although upright plants of *Acacia* are widely distributed, the prostrate forms may be restricted to Sinaloa.

Morphologically the *A. farnesiana* populations of Mexico differ from those of the Caribbean. As shown by Peacock and McMillan (1968) the Caribbean plants have larger leaves than those of Mexico and Texas when grown under controlled environmental conditions. McMillan and Cope (1969) showed that the widespread distribution in South America, Africa, Hawaii, and Europe is of the Caribbean type. Isely (1969) has referred the Caribbean type to *A. farnesiana* and the Texas-Mexico type to *A. smallii* Isely. The populations in Mexico west of Sierra Madre Occidental have pods that are longer and more slender than those of populations east of the mountain range and probably represent a local form of this widespread *A. farnesiana* complex.

Materials and Methods

Scarified seeds were germinated on moist filter paper in petri dishes. The collections represented mixed seed from three plants except those from Altata. The two collections at Altata were from individual plants. Collection sites are cited in Table 1.

One week from sowing the seedlings were individually planted in 23 cm clay pots of fine sandy loam and were placed in a growth chamber with 15-hr light periods and 30° C day and 24° C night temperatures. The seedlings were in the growth chambers for 45 days and were subsequently in the greenhouse over-winter. The plants were transferred to out-of-doors conditions from April to November.

TABLE 1. PROSTRATENESS IN ACACIA FARNESIANA FROM WESTERN MEXICO UNDER UNIFORM ENVIRONMENTAL CONDITIONS

Collection site	Prostrate index (stem fraction × angle)	SD	Mean total stem length (cm)	Mean basal stem section (cm)	Percentage of total stem	Angles of basal stem section (°)
Beach						
1. Mazatlan-A	77.5	9.3	74.3	13.8	18.6	77.1
2. La Cruz	62.4	3.4	72.0	17.6	24.4	76.0
3. Altata-A	60.6	14.0	40.7	11.3	27.8	75.0
Altata-B	54.5	9.1	61.7	15.4	25.0	65.5
Average	63.8		62.2	14.5	24.0	73.4
Inland						
4. Culiacan	38.5	19.9	37.9	14.9	39.3	88.0
5. Esquinapa	36.4	6.9	60.8	24.3	40.0	88.7
6. Mazatlan-B	21.4	8.8	45.1	24.0	53.2	90.0
7. Los Mochis	14.5	5.6	38.1	22.5	59.1	87.5
Average	27.7		45.4	21.4	47.9	88.6

Measurements were recorded on ten one-year-old plants for each collection. The length of each stem segment or branch was measured and its fraction of the total stem calculated. The angle of a segment was calculated by drawing a straight line from the tip to the base of that segment and giving its departure from vertical. Each fraction was multiplied by its angle and the results summed as a prostrate index. A completely upright plant would have an index of 0° and a totally prostrate plant an index of 90°. The length of the basal stem portion and its angle of orientation are given in Table 1 with the indices of prostrateness.

Results

The three beach populations, Mazatlan-A, La Cruz, and Altata (—A, —B), had the greatest indices of prostrateness (Table 1). The Mazatlan-A plants showed the greatest total stem growth and the lowest percentage of stem as a basal straight portion. Although La Cruz and Altata plants were more similar to Mazatlan-A plants than to those of inland populations they were intermediate between Mazatlan-A and Culiacan populations.

The average prostrate index for the four beach collections was 63.8 and for the four inland collections was 27.7. The distinctness of the two groups is affected, however, by the large standard deviation of the Culiacan collection. This Culiacan material suggests prostrate tendencies within inland plants.

The initial stem elongation for all four inland collections was more upright, 87.5–90.0°, than that of the beach collections, 65.5–77.1°. The plants of Altata-B showed the greatest tendency for stems to develop initially away from the vertical and those of the upright population, Mazatlan-B, had the greatest tendency for initial vertical orientation.

The Mazatlan collections show a strong contrast in prostrateness (fig. 1). Mazatlan-A from the beach with a prostrate index of 77.5 and Mazatlan-B from an inland site with an index of 21.4 nearly span the total range of index values. Because the distribution at Mazatlan is not continuous, it was not possible to determine if a gradient of prostrateness occurs in one region.

Discussion

Populations of *A. farnesiana* from western Mexico showed diverse stem orientation under the same environmental conditions. Whereas all of the plants produced branches at diverse angles, those of the sandy beach habitats showed the greatest tendency for the branches to depart from the vertical. Plants grown from seed collected in inland sites showed a selection toward more upright stem production.

The prostrateness of the experimental populations correlated with the prostrateness of the parent plants. The plants grown from seed collected on the Mazatlan beach showed the greatest prostrate index and the

FIG. 1. Comparison of plants from Mazatlan, Sinaloa. The plants are from seed collected in the beach population (1,2) and in the population on clay soils 4.8 km east of the beach (3,4).

plants in the beach ecosystem were the most prostrate of those examined in Sinaloa. The experimental plants from Altata were the least prostrate of the beach populations. At Altata, the plants were not on fore-dune habitats as at the other two beach sites and were the least prostrate of the beach populations.

Hannon and McMillan (1972) compared plants from the Mazatlan beach with plants of Saltillo, Coahuila, and demonstrated that prostrateness was modified by interaction with light intensity. Beach plants were much more upright under low light intensities but inland plants were only slightly modified by various conditions of light intensity, temperature, and photoperiod. The greater niche plasticity of the beach population offers selective advantage in instable coastal ecosystems. The ability to produce upright stems in low light intensity provides competitive advantage in the dense growth of a subtropical beach ecosystem and the production of prostrate stems under higher light intensities results in sand dunes with a protective cover of thorny stems.

ACKNOWLEDGMENTS

Funds for this research were provided in part by National Science Foundation Grant GB-6097. I acknowledge the assistance of Virgil Wade, and Kent N., Michael K., and John K. McMillan in collecting along the coast of Mexico. Dr. David S. May assisted in data processing.

Literature Cited

Hannon, N. J. and C. McMillan. 1972. Stem orientation in two populations. of *Acacia farnesiana* from Mexico under controlled environmental conditions. Bot. Gaz. 133:368–376.

Isely, D. 1969. Legumes of the U. S. I. Native *Acacia*. Sida 3:365–386.

McMillan, C. and J. M. Cope. 1969. Response to carbon monoxide by geographic variants in *Acacia farnesiana*. Amer. J. Bot. 56:600–602.

Peacock, J. T. and C. McMillan. 1968. The photoperiodic response of American *Prosopis* and *Acacia* from a broad latitudinal distribution. Amer. J. Bot. 55: 153–159.

NOTES AND NEWS

A Lectotype for the Hinds Walnut.—Jepson wrote about the Hinds walnut at least seven times between 1908 and 1923, either as *Juglans californica* Watson var. *Hindsii* Jepson (Bull. S. Calif. Acad. Sci. 7:23,24. 1908; Flora of California 1:365. 1909; Trees of California, p. 145, 1909; Silva of California, Memoirs Univ. Calif. 2:195. 1910) or as *J. Hindsii* Jepson (Madroño 1:55–57. 1917; Trees of California, second edition, pp. 109, 215. 1923; Manual of the flowering plants of California, p. 279. 1923), but at no time did he cite a collection. Moreover, no collection, either in the Jepson Herbarium or in the University of California Herbarium, has been indicated as the type. Since there continues to be some doubt as to the precise taxonomic status that should be accorded the Hinds walnut (cf. Munz, P.A., 1959, A California flora, p. 909) as well as to the interpretation of its floristic position (cf. Thomsen, H.H., Madroño 17:1–10. 1963), it is desirable and important that a lectotype be designated.

The following specimen has been selected to typify this walnut: *W. L. Jepson No. 2189,* collected May 3, 1903, on the east slope of the Napa Range near Wooden Valley, Napa County; JEPS 58696. This collection was known to Jepson throughout the years when he was concerned with the tree, and it came from one of the localities listed by him when he diagnosed the plant both in English and Latin (Jepson, W. L. 1909. Flora of California 1:365). The locality was also cited by Ralph E. Smith (Univ. Calif. Agr. Exp. Sta. Bull. 203:27, 1909) in whose account of the native California walnuts the specific name was first published and who described the locality even as recently as 1949 (Pacific Disc. 2(6):14).

At this time, when designating a specimen to typify the Hinds walnut, it is appropriate to review the proper author designation for the specific name that has been variously given as Jepson, (Jepson) Jepson, Rehder, (Jepson) Rehder, and Jepson ex R. E. Smith. The last, as it is given by both Rehder (Rehder, A. 1949. Bibliography of cultivated trees and shrubs hardy in the cooler temperate regions of the northern hemisphere, p. 128) and by Little (Little, Jr., E. L. 1953. Check list of native and naturalized trees of the United States (including Alaska). Agricultural Handbook No. 41, p. 214), is the correct author designation. Although the publication of the varietal name in January, 1908, preceded by nearly two years the publication of the specific name in November, 1909, Smith makes no allusion to the varietal name in his paper. The first use of the specific name by Jepson himself (Madroño 1:56. 1917) was simply *Juglans Hindsii* Jepson—but it is well-known that Jepson employed parenthetical authorship erratically.

I am grateful to Dr. L. R. Heckard, Curator of the Jepson Herbarium, for help in the selection of this type.—John Thomas Howell, Department of Botany, California Academy of Sciences, San Francisco 94118.